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SOME SOCIAL IMPLICATIONS OF THE SCIENTIFIC METHOD[1]

By Professor L. H. MacDANIELS

CORNELL UNIVERSITY

SEVERAL considerations have led me to choose the present title, which I know will appear to many of you, at least at first sight, to be rather inappropriate for presentation before the American Society for Horticultural Science. Among these is the fact that our society is becoming mature. Attendance is now larger and more varied than formerly, and it seems not out of place to consider matters of a general nature rather than to continue the technical discussions of the regular sessions. Not that we should be less jealous of the pursuit of scientific knowledge, but rather that now we have established our position as a first-class scientific society we can pause momentarily and examine our situation with relation not only to other scientific societies, but to the whole field of knowledge as well.

The subject is certainly timely. With most of the world at war or near war it is all too obvious that our control of physical forces has far outstripped the capacity or at least the will of the human race to manage their affairs in a satisfactory way. Such a statement is trite in view of the many efforts now being made to increase the sense of responsibility among the scientists for the social order. This trend has been emphasized recently by the National Research

[1] Address of the president of the American Society for Horticultural Science, presented at the Philadelphia meeting of the society, December 30, 1940.

Council in its consideration of the obligation of the scientists of America to society in general and the defense program in particular.

It is timely also because the method and approach used by many, or should I say most, scholars in studying and attempting to solve the problems of human relationships, including economics, sociology and ethics, are at the present time apparently confused and ineffective. There has not been adequate leadership in these fields at a time when such leadership has been far more important than technological advance and control. Economic bungling of both governmental and private institutions and in industry during the past years of depression has brought out only too clearly the inadequacy of our society to handle the really important problems. It is indicated particularly by the failure among economists to have any answer upon which they can agree and no widely accepted method of approach to economic problems.

Modern ethics also is in a confused state. This was brought out most forcibly in a recent course of lectures on "Ethics and Modern Life," given at Cornell by a leader in that field. The titles of some of the lectures will indicate the confusion of thoughts and ideas that apparently exist. The first title was "The Dilemma of Modern Ethics." The dilemma seemed to be that there is no way by which the problem of human conduct could even be considered. Ideas just don't have any contact with action, and every term that is used is a dilemma in itself. The second lecture was on "The Venture of Moral Philosophy." The venture appeared to be that it was most extraordinary that any one would have the temerity to even try to do anything about conduct. The third lecture had to do with the divergence of theory and practice in which it was again brought out that it is practically impossible to bring ideas to bear upon the world of fact and experience. In the fourth lecture entitled, "The Modern Experiment; Ideas and Immediate Experience," it looked as if the lecturer were going to arrive at something which at least faintly resembled an effective approach to the problem, the scientific approach, if you please. The startling concept was advanced that possibly ideas could be brought to bear upon immediate experience. In the last lecture of the series, however, entitled "The Persistent Tension in Experience and Morals," the idea was given up and it was indicated that the whole matter was in a condition of confusion, futility and conflict. It gave no real hope to the human race for ever doing anything effective in directly meeting their problems in the improvement of social and moral relationships which is so necessary if civilization is to continue. Yet this authority in the field of ethics received nearly $6.00 a minute for bringing his audience to such a state of confusion and impression of futility. The above picture is, of course, overdrawn and can not be used as a basis for generalization. It does, however, contrast rather sharply with the situation where the scientific method is used as a tool in the solution of problems.

It is my belief that the method of science or the scientific approach is useful and effective in interpreting phenomena in all fields of human knowledge and endeavor and will aid in the solution of all problems with which the human race is confronted. It is also my belief that we as scientists have the opportunity if not even the obligation, of bringing to bear upon the problems of living, both private and public, the method and approach of science. I submit that this method has had an outstanding record of accomplishment in the fields where it has been used and that the extension of its use as a working hypothesis for the solution of all problems is more practical and effective than any approach so far devised.

Before going further it is essential to make clear just what is meant by the scientific method. Here I know that much that is said will seem trite and well known to most or all of you. It is, however, necessary that such a statement be made, otherwise we do not know just what we are talking about.

Behind the scientific method are a number of basic assumptions which are taken as axiomatic. The first of these is that everything that takes place in the universe as we know it takes place in accordance with natural law. The second is that the human mind is capable of comprehending and understanding this natural law and hence can understand the universe. If this were not true the scientist could not work. What would be the use of spending our time investigating something that we can not understand. Of course, there is much in the universe of which we are not aware, much that our senses do not perceive, but we must assume that all could be perceived and understood if we were given, or if we devised, the proper instruments to perceive. The proof of such assumptions is that they work.

The radio is an obvious case in point. The natural law underlying the development of the radio has always been there. Radio waves, as such, are quite beyond the perception of any of our natural senses. However, by understanding the nature of these waves and how to control them it is possible to translate electric impulses into sound that we can perceive and enjoy. The air at this moment is full of all sorts of programs which, I am thankful to say at the moment, we do not perceive. By bringing in a radio properly tuned we are able immediately to make this apparent silence more audible.

As a further illustration of just what is meant by natural law I might cite the periodic table of atomic

weights as formulated by Mendeleyev in 1869. At that time only 70 elements were known, but on the basis of his hypothesis he postulated that there were 92 and went so far as to describe the properties of some of these that were still unknown. Within a comparatively few years 15 additional ones had been found, and now I believe all have been accounted for. When it was published in the newspaper that element 87 had been discovered it was no surprise. The chemists had known all along that it was there. Another example of what we mean by natural law is the comparatively recent discovery of the planet, Pluto. Astronomers knew by the behavior of other planets that such a planet existed and it only remained for a more powerful telescope to confirm its position. Who would doubt that the laws of astronomy have existed from the first? And so it is with other natural law.

Why many fail to appreciate the implications of the scientific method is that they do not consider natural law of universal application and are inclined to limit its scope to the physical sciences or to those in which material can be accurately weighed or measured. It is here that the greatest progress has been made and it is here that the factors with which the scientist deals are capable of the best controlled manipulation. Lord Kelvin has stated and I quote, "When you can measure what you are speaking about and express it in numbers, you know something about it, but when you can not measure it, when you can not express it in numbers your knowledge is of a meager and unsatisfactory kind: it may be the beginning of knowledge but you have scarcely in your thoughts advanced to the stage of science." This is a very significant statement, and in so far as the material concerned is capable of being measured and expressed in numbers it should apply. But certainly there is no particular virtue in numbers as such, and if the number does not honestly represent what it is supposed to represent it can be more misleading than a statement in words because the number gives an impression of accuracy that does not exist. It is my belief that some economists and biometricians have only confused our knowledge by using and manipulating numbers. Further, what is to be done with that great mass of phenomena which can not be measured and reduced to numbers but which is far more significant and important to human living than anything in the field of the physical sciences?

It might be possible to arbitrarily limit science by definition to those fields in which the material dealt with can be weighed, measured and expressed in numbers. This, however, is an untenable position because what we can measure to-day is far different from what we could measure yesterday and no one can venture what we may be able to measure to-morrow. To set up such an arbitrary limit implies that somewhere in our universe there is a limit beyond which the scientific method does not apply. But there certainly is nothing in the basic assumptions of the scientific approach that would justify setting such limits. These assumptions are simple, namely, that the universe operates according to natural law and we as human beings can understand natural law and hence the universe. To say that this does not have universal application is to say that part of our universe is chaos and without causal relationship between events which take place and the forces and conditions that have brought them about. Personally I know of no scientist or scholar that would admit that such chaos exists anywhere and I insist that it does not.

Because of this concept that nothing is really science unless it deals with things that can be measured and given numerical values there has grown up a sort of hierarchy or aristocracy among the sciences in which the physicists and the chemists hold themselves somewhat aloof from the biologist, the psychologist, the economist and the sociologist, apparently feeling that after all physics and chemistry are the only true sciences and that the others are only pseudo-science. The biologist and the psychologist because they can effectively employ the experimental method in turn are inclined to look down their noses at the social sciences as being on an even lower grade of pseudo-science. This situation has been admirably described by Professor Boynton, of Chicago University, in his chapter on "Knowledge and Wisdom" in a recent book.

Apparently much of the difficulty is based on the assumption that nothing is truly scientific unless it can be adapted to experimenal treatment in the laboratory. It is true that the experimental method has been identified with science itself from the first and rightly so, and that it is through experimentation that the outstanding advances of the past few decades have been made possible. It is also true that in the fields of knowledge which deal with human relationships and esthetics, experiments of the accepted laboratory type are difficult. This does not mean, however, that the basic principles of the scientific approach do not apply.

To emphasize this universality of natural law, it is useful to consider it as operating in different fields or at different levels. With no attempt at a complete classification we might set up a system something like this. First of all, there would be the physical level which would include physics and chemistry. The fact that chemistry in its last analysis is atomic physics is not important for developing the concept. Next would be the biological level. Here we are dealing with living things, the nature of protoplasm, the

physiology of plants and animals and such matters as health and medicine. Here would be considered all parts of man's nature that had to do with his biology. Psychology has to do with the workings of the mind and might be regarded as a phase of biology or at least to have an intimately associated biological basis. The process of thought is more complex and of a somewhat different nature than the physiological processes of digestion or respiration and for that reason psychology may well be set off from biology as such.

The social level has to do with relations between persons both as individuals and in groups and includes economics, sociology and ethics. We might also speak of an esthetic level or field which has to do with the appreciation of art and literature and poetry. Ethics and esthetics merge directly into what might be termed a spiritual level. In dealing with these upper levels the concept of value comes in. Thus, we speak of economic values, moral values, spiritual values. No attempt is made to give an exact relationship of these. The point to be made is that as we progress from one level to another there is continuity. If we accept evolution as a fact this could not be otherwise.

Also as we progress from one level to another, or from one set of values to another the nature of the natural law that is operating becomes increasingly more complex. It is, however, none-the-less real because it becomes less tangible and more difficult to handle experimentally. To further illustrate the point I am trying to develop it is well to consider some of these levels in more detail. The operation of physical law is obvious and accepted. No scientist has any doubt of its validity and the same is true of natural law in the biological field. This is the level with which the members of this Horticultural Society are primarily concerned. We recognize the application of chemistry and physics to our problems. But here in the biological field a new element that is very important comes in. We are dealing with living matter or protoplasm and its behavior not only as a substance, but as it is integrated in more complex organisms. The distinctive thing about protoplasm, however, is not the presence of certain chemical elements, but rather the integration of these. Of course, the elements which enter into the composition of protoplasm are essential, but merely to mix these in any given proportion is not to have protoplasm. The important thing about this substance is its organization, a thing which we destroy as soon as we try to treat it with chemical or physical techniques. It may be that eventually protoplasm will be partially explained in terms of stereo-chemistry and in last analysis atomic physics will contribute greatly to our understanding of its behavior. This, however, does not invalidate the concept. The important thing with which the biologist deals is protoplasm as such and its behavior as a living integrated functioning entity that is more than the sum of the chemical elements of which it consists.

The question of absorption of water by roots and its movement into the xylem vessels was not explained satisfactorily as long as such movement was regarded as an osmotic phenomenon carried on by purely passive physical forces. It can be explained, however, on the basis of the action of the protoplasm as a living substance which moves salts against a diffusion gradient and secretes them into the vessel in such concentration that water can then move by osmosis. In the process energy is used and work is done and this depends upon the organization and functioning of the protoplasm itself. To be sure physical laws are concerned and none has been violated, though just how they work may not be too clear. The significant fact with which we are dealing, however, is the whole organization of protoplasm and cells and tissues which makes this phenomenon possible.

In the field of horticulture the use of chemical methods has been valuable in some problems. Too often, however, the chemist, particularly if he is not a horticulturist as well, has not contributed to the solution of problems as much as hoped for because of his failure to appreciate the plant as something other than a mass of chemical elements and compounds. As horticulturists we must never lose sight of the plant as a living functioning organism that is more than the sum of the chemical elements of which it is composed. This idea was well expressed by Dr. E. W. Sinnott in his presidential address before the Botanical Society in 1938. It certainly is one that we as horticulturists should not ignore.

In biological problems, particularly in studying the physiology of plants and animals we continually use the scientific approach at least in our basic concepts and attitudes. We assume that what we observe is going on according to natural law and that we can understand it. We are so sure of this that when apparent exceptions occur we merely conclude that our conception of the natural law that is operating is wrong and that we must search further to find out what is basically involved. This approach which we all use has been adopted because of the fact that in general it works, or at least works much better than any other approach which has been devised.

An example of the use of this approach might make our meaning more clear. Some weeks ago in the greenhouse at Cornell a chrysanthemum plant normally with dark bronze flowers was observed in which a part of the flower heads were light yellow, a part dark bronze and in some heads the florets were dark in the lower part of the head and light in the upper

The question arose immediately as to the cause of this difference in color. Because of the position of the flowers, it was evident that bud mutation was not the answer. The difference in color was apparently related to the proximity to a steam pipe. Such an observation immediately suggested the possible effect of heat upon the color of the flowers in question. This, of course, is tied up with the nature of the coloring matter concerned. Knowing that the color was anthocyanin and that this is a derivative of sugar, immediately the problem becomes related to the sugar supply available for the production of this coloring matter. Increase in temperature is, of course, related to respiration so that the possible explanation might be that the color pigment was absent from the flowers next to the steam pipe because of the loss of sugar through increased respiration. Another relationship indicated in the heads with dark florets below and the light above was the effect of the progressive shortening of day length in relation to carbohydrate manufacture. Heads that had color in the basal florets might have developed relatively earlier during longer days than those in the center. Under such conditions the sugar supply available at the time the florets were forming might be the controlling factor in determining the color. Doubtless other factors were also operating, and in any case these hypotheses would have to be proved experimentally before acceptance.

This example merely illustrates the scientific approach to a problem. First, we ask the question, "What is it that has happened and what are the materials involved?" Next, "What are the factors operating that might bring about the changes which we have observed?" Then, "What are the natural laws which are operating in controlling these factors?" It is my contention that this method of approach is valuable in approaching any problem.

At the psychological level we are dealing with something a little different from that found at the lower levels. Here again there is increased complexity. Nevertheless there is continuity in the natural law operating in the psychological field throughout the animal kingdom. There is no break between man and the other animals. The psychologists, of course, or at least many of them, have recognized this and have adopted the scientific method. Certainly there would be no logic in working with rats, dogs or pigs if this continuity did not exist. The natural law underlying psychological behavior seems to be relatively well understood compared to such understanding in the fields of economics and ethics. At least it is being made of practical use on a wide scale. We have only to mention such terms as "child training," "high pressure salesmanship," "propaganda" and the like to show this to be a fact. The astounding effectiveness of the Hitler régime is based largely on the control of some psychological factors. We can only hope that his knowledge is inadequate to carry out his plans in their entirety. Certainly neither the effect of bombing upon the British morale nor the imprisonment of the German clergy in concentration camps has worked out as was planned and indicates a lack of understanding of the psychology of these people.

Here again in the psychological field we are dealing with natural law that is unlike physical law and unlike most of the natural law in the biological field also. We are concerned with human response. Attempts are made to reduce human behavior to terms of endocrine secretions, blood pressure and similar factors. To get any significance out of human relationships, however, it is futile to reduce human behavior to such terms. The minute we try to break down a human reaction in terms of solutions and secretions the thing itself is lost. It is like trying to find out the nature of protoplasm by subjecting it to chemical analysis. As soon as it is manipulated with chemical techniques the significant thing about it no longer exists. For example, take the behavior of an affectionate child toward its father. On meeting after a separation, at the first sight of the parent the child comes running to him with every expression of eagerness and joy. Such actions are doubtless associated with various physical and chemical stimulations and electrical phenomena of one kind or another. However, these are not the significant things about it. The significant fact with which we are dealing is the whole complex phenomenon in its entirety.

In the field of economics the situation becomes even more involved and complex because we are considering not the psychology of an individual but the behavior of groups of individuals with regard to other groups and are also concerned with their relationship to various materials and commodities. Yet there is no question but in this field there are laws which operate in spite of Federal Farm Board legislation and the Agricultural Adjustment Administration or any other governmental organization. It seems to me evident that much of the difficulty of the past years during the depression is due to the fact that many economists do not use the scientific approach to their problems. Although some of them do use this approach there is such disagreement as to valid methods that great confusion has resulted. It is also entirely possible if not altogether probable that some of the so-called natural laws which have been thought to operate in the economic field are not valid. This does not mean, however, that such law is wanting and that it may not be discovered if studied in an effective manner.

In our personal relations with others natural law is

operating, also. The so-called laws of friendship have a very real meaning. It must be perfectly obvious to all of you that certain reactions in other people will follow certain courses of action on your part. It is quite possible to make another angry or to arouse many other positive or negative reactions at will.

The field of ethics has to do with personal conduct as related to what is right or wrong. Here, conduct must be judged in the light of the society in which it occurs. A thing is good or bad, moral or immoral, only when related to some specific situation or environment. Still there is no chaos, though some would say that there was. I recall hearing a famous criminal lawyer discussing this matter before a gathering of college students at Wesleyan University, Connecticut. The whole effect of his talk was to leave the students with the idea that there was no basis for judging conduct as moral or immoral, good or bad, and the general concept was that society had no right or justification in punishing criminals for what they do because it had no valid standards of what is right or wrong. It would seem to me that this conception was contrary to fact at least in so far as holding that there was no way to determine what was right or wrong. In this day and age and in our society a person of good moral character is a perfectly definite sort of person. We know what to expect in the way of behavior from such an individual. Each one of us has friends about whom we would not believe a report of their having done an immoral or disgraceful act. On the other hand, we may also have acquaintances about which such reports would be accepted as the thing to be expected. A possible concept of ethics might be stated after this fashion—Behavior is right or ethical if it is in accordance with natural law operating in a constructive manner. This has to do only with human behavior, as there is no ethics in the field of physics and chemistry.

In considering any behavior the level of the natural law that is operating must be considered. A thing may be right at one level and wrong at another. Certain behavior for example may be quite moral on the biological level with no immoral social implications whatever in a society like that of the early Polynesians, whereas the same course of action might be highly immoral in our own society judged on the basis of its biological, economic or social significance.

It is not my purpose to discuss ethics further than to point out the fact that natural law is operating in this field also. It is my firm belief that there is a fundamental and universal law governing human conduct under which human beings can achieve the best possible and most satisfying relationships. This has to do with many things that are known and recognized. The qualities of honesty, loyalty, truth, decency, kindness, unselfishness and the like are constructive in their effect upon individual and social life and in the long run will make for a better society than their destructive counterparts. It is obvious that if individuals and nations conducted themselves along these constructive lines the chaos which now confronts the civilized world would not exist. The point is emphasized here that any problem of ethics can be approached effectively by using essentially what we understand as the scientific method. It is granted without argument that our knowledge of natural law is incomplete, particularly at the economic, social, ethical and spiritual levels and that the technique of the chemistry laboratory can not be carried over directly into the field of sociology and ethics. Not so long ago, however, chemical and physical laws were also unknown. Certainly no scientist can take the position that anything will be impossible in the future in the way of understanding and in controlling our universe. Further and more important, I would maintain that the scientific method is the most effective approach we have in dealing with our problems of whatever sort and can be taken as a working hypothesis upon which we can base our activities. At least, until we find a better one it will go far in giving meaning to our universe in fields where otherwise chaos and confusion exist.

I hope that I am not being misunderstood. It is the farthest from my desire to advocate that the members of this society become less zealous in doing effective work in the science of horticultural research. Rather, it is to point out that we as scientists should realize more fully that in the scientific method we have an extraordinarily effective technique that can be brought to bear upon the problems outside the field of the physical and biological sciences. Further it is our opportunity and obligation to take some responsibility for the social and political order in which we work and which makes our work possible at all. With such a broad concept of responsibility the scientist would not abandon the scientific method when he closes the door of his laboratory each day, but would carry the same critical and dynamic approach with him wherever he goes.

In these troublous times when four fifths of the nation paused to hear President Roosevelt's statement of the crisis with which we are confronted, we as scientists are in a favored position to be of outstanding service. We, more than any other group, have the approach that will be most effective in meeting the problems raised by events as they come, provided, of course, that we realize at least some of the social implications of the scientific method.

OBITUARY

ROBERT THOMAS HILL
1858–1941

ON July 28, in Dallas, Texas, Dr. Robert Thomas Hill, well-known geologist and the author of many papers, died at the age of eighty-two years. He was born in Nashville, Tennessee, and at the age of five was orphaned by the Civil War. When fifteen years old, he moved to Comanche, Texas, which at that time was "the last town of the frontier and the roughest and toughest of that age." Here he helped set type on his brother's weekly, the *Comanche Chief;* punched cattle; and had a variety of hard experiences which, in later years, gave him subjects for many an exciting tale.

As has so often happened, so, too, in Robert Hill's case, discovery of a fossil shell awakened his first interest in geology. This was while he was still in Tennessee. He broke the corner off a block of rock and thus exposed a shell impression which started his career. However, not until he was in his twenties did he finally take the advice of a barber friend who urged him to write to the *New York Sun* for information as to where a young man might get an education. He was told to write to President Arthur D. White of Cornell and, having received an encouraging reply, he went east and began the four years of educational training which led to a bachelor of science degree in 1886. These years were not easy, for he had to earn his living and his tuition by various odd jobs, but he always remembered them as among the happiest years of his life.

Following graduation, Hill was appointed assistant paleontologist on the U. S. Geological Survey. In 1888 he became assistant geologist, and in 1889 he was promoted to the grade of geologist, a position which he held until 1904. In 1898 he was also geologist on the Arkansas State Geological Survey. From 1889 to 1891 he was professor of geology at the University of Texas. In 1895 he cooperated with Professor Alexander Agassiz in West Indian exploration. His studies carried him, also, into New Mexico, Mexico and the Isthmian region. Thus, it happened that he acquired wide experience in the geology of the lands fringing the Gulf of Mexico and in the Antillean region.

Evidence of this concentration in his work appears in his numerous contributions to geologic literature, of which there are at least 150. Of these a large number relate to Texas, but not an inconsiderable number refer to Arkansas, New Mexico, Oklahoma, Mexico, California, Cuba, Puerto Rico, Jamaica, Costa Rica and Panama. Although, in his writings, he stressed geology, stratigraphy and geography, some described prospects for clay, oil, ores, coal and marble. Greatest of his economic contributions, however, were his reports on artesian water resources in Texas.

Two comprehensive treatises cover Hill's work on this subject of underground waters. The first, written with T. W. Vaughan as co-author, was entitled "Geology of the Edwards Plateau and Rio Grande Plain adjacent to Austin and San Antonio, Texas, with reference to the occurrence of underground waters," and was published in the 18th Annual Report of the U. S. Geological Survey, in 1898. The second, "Geography and Geology of the Black and Grand Prairies, Texas," appeared as the 21st Annual Report of the U. S. Geological Survey in 1900. In these two monumental reports are the data and recommendations which, throughout a broad belt in Texas, have guided farm and industrial life in the exploitation of valuable water resources. The usefulness of these two volumes has been inestimable.

In the later years of his life, Dr. Hill wrote little on geology, but he began a series of articles, which he continued for several years in the *Dallas News,* on the wanderings and expeditions of the early whites in Texas and adjoining states. Due to his intimate knowledge of the geography and geology of the region, he was able to trace the routes followed by the old Spaniards and others who laid the course of this chapter in American history.

Dr. Hill belonged to many scientific societies. He was a founder member of each of the following: the Geological Society of America, the Washington Academy of Science, the American Society of Professional Geographers, the Southwestern Geological Society, the Branner Geological Society of Los Angeles, the Society of Economic Geologists, the Texas Historical Society, the Engineers Club of New York, the Explorers' Club, and others.

Dr. Hill was small of stature and in the later years of his life he was blind in one eye and was so deaf that conversation with him was difficult. Yet he kept in remarkably close touch with everything going on in the field of geology; his reduced vision was still keen, for he seldom failed to recognize his friends even at a distance, and he could enjoy examining rock outcrops and rock specimens. To the last his mind was as clear as crystal and his memory was extraordinary. He was a man of wide interests, strong for what he believed was right and fair, but relentlessly opposed to graft and bigotry and other forms of human corruption. He was especially outspoken against political and economic issues which he thought were adverse to the common good. In his passing he has left a host of friends and admirers, not only the hundreds of

geologists and other technical men who knew him, but also thousands of persons in many other walks of life.

FREDERIC H. LAHEE

RECENT DEATHS

DR. DANIEL DANA JACKSON, since 1918 professor and head of the department of chemical engineering at Columbia University, died on September 1 at the age of seventy-one years.

FRANK LEWIS EIDMANN, since 1930 professor of mechanical engineering at Columbia University, died suddenly on September 4 of a heart attack in his laboratory. He was fifty-three years old.

BRIGADIER-GENERAL CHARLES HAMILTON MITCHELL, hydraulic engineer, who recently retired as dean of the faculty of applied science and engineering at the University of Toronto, died on August 26. He was sixty-nine years old.

CLAUDE MACKENZIE HUTCHINSON, bacteriologist, formerly chief scientific adviser in India to the Imperial Chemical Industries, died on August 2 at the age of seventy-two years.

SCIENTIFIC EVENTS

INTERNATIONAL RELATIONS OF SCIENCE

THE Division for the Social and International Relations of Science of the British Association for the Advancement of Science is arranging a meeting to be held, if circumstances allow, on September 26, 27 and 28. Various subjects under the general heading of "Science and World Order" will be taken up. The first day's session will be held at the Royal Institution, London, and those of the second and third days at the Rothamsted Experimental Station, Harpenden.

Since the above note, received from English sources, has been in type a Reuter dispatch dated September 7 has been printed in *The New York Times*, which reads: Representatives of Great Britain, the Empire, the United States, Soviet Russia and China will meet in London for a scientific conference from September 26 to 28, "to demonstrate the common purpose of men of science in insuring a post-war order in which the maximum benefits of science will be secured for all people." United States Ambassador John G. Winant, Soviet Ambassador Ivan M. Maisky and Dr. V. K. Wellington Koo, Chinese Ambassador, will preside at some of the sessions. Czecho-Slovakia, Poland, Norway, the Netherlands, Belgium and France will be represented, and scientific workers from Germany and Austria will probably also be present.

In reply to the cable of greetings sent by the Royal Society, London, to the Academy of Sciences of the U.S.S.R., quoted in SCIENCE for August 29, Dr. Otto Schmidt, vice-president of the academy, according to English journals, has sent the following message: "The Academy of Sciences of the U.S.S.R. sends its warmest greetings to the Royal Society, London. Soviet scientists express feelings of deep admiration and friendship to British colleagues who in war conditions pursue courageously their research work, obtaining world achievements in various fields of science and thus successfully opposing the aim of Fascism to destroy all culture. In the struggle for the happy future of humanity, standing hand in hand against the common foe, men of science of Great Britain and the Soviet Union will contribute with all their forces to the triumph of liberty, culture and science over Hitlerite tyranny and obscurantism."

THE OFFICE OF DEFENSE HEALTH AND WELFARE SERVICES

AN Office of Defense Health and Welfare Services in the Office for Emergency Management has been established in Washington by President Roosevelt, who has issued a proclamation detailing the functions of the agency. Paul V. McNutt, head of the Office for Coordination of Health, Welfare and Related Services in the Council of National Defense, has been named director.

The functions of the new agency were outlined in the proclamation as follows:

Subject to such policies, regulations and directions as the President may from time to time prescribe, the office shall:

A. Serve as the center for the coordination of health and welfare services made available by the departments and agencies of the Federal Government, and other agencies, public and private, to meet the needs of state and local communities arising from the defense program and take necessary steps to secure the cooperation of the appropriate Federal departments and agencies relative thereto.

B. Make available to states and localities, upon request, the services of specialists in health and welfare activities to assist in the planning and execution of such local and state programs.

C. Study, plan and encourage measures designed to assure the provision of adequate defense health and welfare services to the citizens of the nation during the period of emergency and coordinate studies and surveys made by Federal departments and agencies with respect to these fields.

D. Keep the President informed with respect to progress made in carrying out this order and perform such related duties as the President may from time to time assign or delegate to it.

THE WESTINGHOUSE TIME CAPSULE

THE Park Department of New York City announces that a monument of black granite, erected at Flushing Meadow Park to mark the location of the Westinghouse Time Capsule on the old site of the New York World's Fair, will be dedicated at noon on Tuesday, September 23.

At the public ceremonies sponsored by the Park Department, Robert Moses, Park Commissioner, will preside. David S. Youngholm, vice-president of the Westinghouse Electric and Manufacturing Company, will present the marker, and Mayor F. H. LaGuardia, or his representative, will accept the memorial on behalf of the City of New York. Executives of the principal companies which had exhibits at the fair, members of the fair administration, city officials and civic leaders will attend. The Time Capsule, a metal tube containing a record of our civilization, was buried fifty feet underground at the Westinghouse Building at the World's Fair to remain there for 5,000 years. It contains thirty-five articles of common use and a microfilm record equivalent to 10,000,000 words of printed matter and was sealed on September 23, 1940, with leaders of American science, industry and public affairs taking part. It is made of copper alloy called Cupaloy which can be tempered to the hardness of steel and yet has a resistance to corrosion equal to pure copper. The torpedo-shaped shell is lined with an envelope of heat-resistant glass set in waterproof wax.

To preserve the memory of the Time Capsule and perhaps aid future archeologists in finding it, a permanent "Book of Record" was distributed to libraries, museums, monasteries and other repositories throughout the world.

The ten-foot black granite monument standing on a white granite base marks the exact spot where the capsule is buried at latitude 40° 44′ 34″.089, north of the equator, longitude 73° 50′ 43″.842 west of Greenwich. An inscription on the base of the shaft reads:

> The Time Capsule, deposited 50 feet beneath this spot on September 23, 1938; preserving for the future a record of the history, faiths, arts, sciences and customs of the people then alive. Scientists and engineers designed it; scholars chose its contents; the Westinghouse Electric and Manufacturing Company placed it here at the beginning of the New York World's Fair, 1939–1940, to endure for 5,000 years.

As part of the development of Flushing Meadow Park, the Park Department approved the construction and erection by Westinghouse of a memorial to mark the Time Capsule site. Five white granite seats, with black granite arm rests, face the shaft in a semi-circle from the south end of the memorial plot, which is 45 by 30 feet in area. The area is paved with dolomite flagstones from the court of the former Swedish Pavilion at the Fair. A replica of the capsule is on display at the Hayden Planetarium of the American Museum of Natural History in New York City, where duplicates of the original contents also are shown.

CELEBRATION AT RUTGERS UNIVERSITY

CONFERENCES in connection with the one hundred and seventy-fifth anniversary celebration of Rutgers University will be held on October 9 and 10. These conferences, which will comprise lectures and symposia in four fields of learning, have been arranged to provide an opportunity for scholars to discuss and correlate present knowledge, and to consider subjects for future research. On October 9 the program of lectures and symposia, in separate sections, will be devoted to social science and to applied science; on October 10, to the natural sciences and to literature and the fine arts.

Dr. Karl T. Compton, president of the Massachusetts Institute of Technology, will give the anniversary lecture before the Section on Applied Science. It will be entitled "Scientists Face the World of 1942." Speakers at a symposium before the section will be Dr. Vannevar Bush, president of the Carnegie Institution of Washington, who will speak on "The Case for Biological Engineering," and Robert V. Trullinger, of the U. S. Department of Agriculture, who will speak on "The Case for Agricultural Engineering."

Dr. Hugh Stott Taylor, of Princeton University, will give a lecture before the Natural Science Section on "Fundamental Science from Plogiston to Cyclotron." "Films in Chemistry and Biology" is the subject of a paper by Dr. Irving Langmuir, of the General Electric Company, and "Nuclear Physics and Biology," of a paper by Professor Ernest O. Lawrence, of the University of California.

The anniversary convocation on October 11 will be addressed by Dr. Clarence A. Dykstra, president of the University of Wisconsin, after which honorary degrees will be awarded.

AWARD OF THE BALY MEDAL OF THE ROYAL COLLEGE OF PHYSICIANS

Nature writes: "Professor Edgar Allen, to whom the Baly Medal of the Royal College of Physicians has been awarded, is professor of anatomy in the Yale University School of Medicine, a post to which he succeeded in 1933 after a very fruitful period of office in the University of Missouri. In both universities his department has proved a vigorous center of research on the sex hormones, and his own contributions to the subject form an essential foundation to

modern knowledge of the endocrine action of the ovaries. Before 1917 attempts to isolate ovarian internal secretions were seriously handicapped by the lack of a specific test for what to-day is called œstrogenic action. In that year Stockard and Papanicolaou showed that the œstrous cycle in the guinea pig is associated with cyclical changes in the vaginal epithelium. Shortly afterwards Allen found that in the mouse, too, œstrus is associated with a specific vaginal phase, and from this discovery it was a short step to his and Doisy's successful application of the vaginal smear technique as a test for the œstrogenic action of ovarian extracts. Once extracts with demonstrable œstrogenic activity were made available, the door was open to the chemical isolation, analysis and synthesis of pure œstrogens. Although Allen did not share in this later chemical work, there can be little question that it would have proved impossible without the simple bio-assay method which he developed.

"Allen's second major achievement was his demonstration in 1926 of the fact that the follicular phase of the uterine cycle in monkeys and man is under the control of œstrogenic hormone. All later work on the primate cycle emerges from this finding, and Allen's own subsequent investigations have a significant place in the structure of present knowledge of the subject. His contribution does not rest here. Allen is that rare combination of research worker and administrator who is able to stimulate in younger men a strong and lasting interest in research. His laboratory is one of the most productive in the United States, and while the Baly Medal is a recognition of past work, endocrinologists the world over know that Allen's laboratory will prove no less successful in the future than it has in the past."

AWARDS OF THE AMERICAN CHEMICAL SOCIETY

THE Priestley Medal of the American Chemical Society was presented on September 8 to Dr. Thomas Midgley, Jr., vice-president of Ethyl Gasoline Corporation, at the opening session of the one hundred and second meeting. Dr. Midgley, discoverer of tetraethyl lead as an anti-knock agent in gasoline, was honored for outstanding achievement in chemical science.

The $1,000 prize in pure chemistry, awarded annually to a chemist under thirty-six years of age, and sponsored this year by Alpha Chi Sigma, the national scientific fraternity, was presented to Dr. Karl A. Folkers, of the Merck and Company, Inc., for important contributions in the field of organic chemistry. Dr. Folkers has isolated many rare alkaloids from tropical plants and has conducted intensive research in the fields of vitamins and pyrimidines.

Professor William Lloyd Evans, of the Ohio State University, president of the society, made the presentations. In an address accepting the Priestley Medal, which is awarded once every three years, Dr. Midgley, who is chairman of the board of directors of the society, gave a demonstration of spectacular industrial developments arising from research with which he has been associated during the past twenty years.

By means of an actual gasoline engine, chemical apparatus, motion pictures and slides, Dr. Midgley demonstrated the effect of anti-knock material in a running engine; the non-toxic, non-inflammable properties of certain organic fluorides largely responsible for a great portion of the air-conditioning industry; the experiments through which he and his associates discovered that rubber containing oxygen could be vulcanized by the addition of Grignard reagents, and the process of commercially extracting bromine from sea water.

His discovery in 1922 of tetra-ethyl lead as an anti-knock agent was made after he and his colleagues in the General Motors Research Laboratories had tried more than 33,000 different chemical compounds without success. Dr. Midgley was born in Beaver Falls, Pa., in 1889 and is a graduate of Cornell University. He holds the Nichols Medal of the New York Section of the society, and the Perkin Medal of the Society of Chemical Industry. The honorary degree of doctor of science was conferred upon him by Wooster College. He is a fellow of the American Association for the Advancement of Science. In September, 1940, Dr. Midgley was stricken with infantile paralysis. Despite his disability, however, he is actively participating in the convention proceedings.

Dr. Folkers was born in Decatur, Ill., in 1906. He received the degree of bachelor of science with honors from the University of Illinois in 1928, and the degree of doctor of philosophy in 1931 from the University of Wisconsin. He was a teaching assistant in 1928 and a research assistant and fellow in 1929-31 at the University of Wisconsin, and a post-doctorate research fellow in organic chemistry from 1931 to 1934 at the Sterling Chemistry Laboratory of Yale University. He is the author and co-author of many publications in the field of organic chemistry. He joined Merck and Company in 1934, and four years later was appointed assistant director of research. Dr. Folkers was co-recipient in 1940 of the Mead Johnson and Company Award for research on the vitamin B complex.

SCIENTIFIC NOTES AND NEWS

DR. LOUIS F. FIESER, Sheldon Emery professor of organic chemistry at Harvard University, has been awarded the Katherine Berkan Judd $1,000 prize of the Memorial Hospital for the Treatment of Cancer and Allied Diseases, New York City, in recognition of "his outstanding contribution in the proof of the active and inactive positions in the molecules of the chemical carcinogens."

HENRY L. WARD, who retired in May as director of the Neville Public Museum, Green Bay, Wis., has been awarded a gold medal by the Illinois Academy of Science for distinguished services to midwest archeological science. He has been succeeded at the museum by Earl G. Wright, of the Chicago Academy of Sciences.

IT is stated in *Nature* that at the recent conferring of degrees at the Queen's University, Belfast, the degree of doctor of science was conferred on Bryan A. Toms, of the department of chemistry of the university.

THE National University of Tucuman, Argentina, elected on July 15 the following honorary collaborating members of the Institute of Anthropology: D. Alfredo Metraux, Yale University; Dr. E. W. Count, New York Medical College; Dr. J. M. B. Farfan, University of San Marcos, Lima; Dr. Maria M. Constanzo, University of Buenos Aires; Dr. Clemente Hernando Raimori, University of Tucuman, and Dr. Guillermo Rohmeder, University of Tucuman.

DR. CALVIN P. STONE, of Stanford University, was elected president of the American Psychological Association at the recent Chicago meeting. Other officers elected were: *Secretary,* Dr. Willard C. Olson, of the University of Michigan, and *Treasurer,* Dr. Willard L. Valentine, of Northwestern University.

ACCORDING to the *Journal* of the American Medical Association, Dr. Desiderio Roman, of Philadelphia, was named on August 16 *president-elect* of the International College of Surgeons at the international assembly in Mexico City, and Dr. Fred H. Albee, of New York, was inducted into the presidency. The *vice-presidents* are: Drs. Chevalier Jackson, Philadelphia; Manuel A. Manzanilla, Mexico City; Herman de Las Casas, Caracas, Venezuela; Alex Stanischeff, Sofia, Bulgaria, and A. M. Dogliotti, Catania, Italy. Dr. Max Thorek, Chicago, is the *international executive secretary.* Dr. Thomas A. Shallow, Philadelphia, was chosen *president* of the U. S. chapter; Drs. Raymond W. McNealy, Chicago, and James R. Jaeger, *vice-presidents;* Benjamin I. Golden, Elkins, W. Va., *treasurer;* Charles H. Arnold, Lincoln, Nebr., *executive secretary,* and George H. Gillen, Denver, *secretary of the scientific assembly.*

DR. PARIS B. STOCKDALE, associate professor in the department of geology at the Ohio State University, has been appointed professor and head of the department of geology and geography at the University of Tennessee. Dr. George W. White, professor and head of the department of geology at the University of New Hampshire, will become professor of geology at the Ohio State University. Dr. J. O. Fuller, of Mt. Union College, Alliance, Ohio, has been appointed instructor in the department of geology at the Ohio State University. He succeeds Dr. George R. Gibson, who resigned last June to become associated with the Magnolia Oil Company.

DR. PAUL M. HARMON, of Indiana University, has been appointed chairman of the department of physiology in the School of Medicine, succeeding Dr. William J. Moenkhaus, who retired in June. Dr. Khalin G. Wakim, of the Mayo Clinic, has been appointed associate professor of physiology.

DR. ROBERT M. MELAMPY, until recently assistant apiculturist of the Southern States Bee Laboratory of the U. S. Department of Agriculture at Baton Rouge, has been appointed assistant professor of zoology at the Louisiana State University. Dr. Melampy's work will be primarily in the field of general and insect physiology.

DR. W. E. KAUFMANN has resigned as professor of chemistry and chairman of the department at Alma College, Michigan, to accept a similar appointment at Carleton College, Northfield, Minn.

DR. HENRI DE BAYLE, a graduate of the University of Pennsylvania, past president of the Pan American Medical Association and formerly Nicaraguan Minister to the United States, has been appointed dean of the new School of Medicine of the Central University of Nicaragua.

DR. JACK CECIL DRUMMOND, professor of biochemistry in the University of London and scientific adviser to the Ministry of Food, has been elected Fullerian professor of physiology in the Royal Institution. He succeeds Sir Frederick W. Keeble.

HARRY C. OBERHOLSER, of the Fish and Wild Life Service of the Department of the Interior, formerly senior biologist of the Biological Survey of the U. S. Department of Agriculture, has retired. He planned to retire a year ago when he reached the age of seventy years, but his appointment was extended for a year to give him time to finish his work on the birds of Texas. He now has been appointed curator of the

department of ornithology of the Cleveland Museum of Natural History, to succeed John W. Aldrich, who left the museum last January.

IT is reported in *Museum News* that Stanley C. Arthur has been elected executive director of the Louisiana State Museum, New Orleans, in succession to Andre S. Chenet, resigned. Mr. Arthur had been president of the board of curators of the museum until his resignation on June 18.

LEWIS W. WEBB, JR., associate professor of engineering in charge, was recently appointed director and executive officer for the Engineering Science and Management Defense Training Program at the Norfolk College of William and Mary-Virginia Polytechnic Institute. This defense program, now serving the needs of defense training in the Virginia Tidewater area, has approximately eight hundred night school students enrolled in science courses.

DR. ROLLA E. DYER, assistant director of the National Institute of Health, and Dr. Norman H. Topping are now in La Paz, Bolivia. They are working with Dr. Felix Vientemillas, director of the National Health Laboratory, in an attempt to determine by experiments on Indian miners in isolated villages the value of a new vaccine for typhus fever. The vaccine, which was discovered by Dr. Herald R. Cox, at the U. S. Public Health Service Laboratory, Hamilton, Mont., has been successfully used in experiments with animals.

DR. JACQUES HADAMARD, professor emeritus of mathematics of the Collège de France, commander of the Legion of Honor, who is now seventy-five years old, has arrived in the United States. He expects to join the Institute for Advanced Study at Princeton.

ACCORDING to press reports, Dr. Paul Langevin, formerly professor of physics at the Collège de France, is being held by the Gestapo under surveillance at Troyes. He was arrested in Paris in December and was released from prison a few weeks later.

IN the early part of August, Fr. Marie-Victorin, honorary president of the Société Canadienne d'Histoire Naturelle, with Fr. Rolland-Germain and M. Auray Blain, of the Jardin Botanique de Montréal, returned from a preliminary taxonomic and ecological survey of the newly opened route from Senneterre to Mont Laurier, Quebec. This highway passes through virgin forest never before visited by botanists, and makes it accessible to study the flora of a northern Laurentian area whose general characteristics have hitherto been unknown.

DR. ERNEST O. LAWRENCE, professor of physics at the University of California, will deliver on September 25 a public lecture, illustrated with lantern slides and experimental demonstrations, on "The Cyclotron in Medicine," under the sponsorship of the Institute of Medicine of Chicago in the auditorium of the Museum of Science and Industry.

DR. ALFRED H. STURTEVANT, professor of genetics at the California Institute of Technology, gave on August 27 the evening lecture at the summer meeting of the Genetics Society of America at Cold Spring Harbor. His subject was "Comparative Genetics of the Species of *Drosophila*."

A CLINICAL session on pulmonary diseases will be held at the Cornell University Medical College under the auspices of the Tuberculosis Sanatorium Conference of Metropolitan New York on October 8. The speakers will be Drs. Norman H. Plummer and Edgar Mayer.

THE opening of the Pennsylvania State College has been postponed for a week, until September 18, on account of the prevalence throughout the state of poliomyelitis.

THE will of William Mitchell Kendall, senior member of the architectural firm of McKim, Mead and White, who died on June 29 at the age of eighty-five years, leaves his estate at Sutton, Me., with $25,000 for its maintenance, to Harvard College as a "place for rest, recreation and study" for members of the faculty and their families.

YALE UNIVERSITY will receive $180,000 by a provision in the will of Mrs. Mary Jewett Wilson, widow of Edward A. Wilson, mining engineer, to found and maintain scholarships to be named after her husband. The amount remaining after scholarships are paid will be contributed to the class of 1871 university fund.

THE *Journal* of the American Medical Association states that the Helis Institute for Medical Research has been created by a trust fund made available by William G. Helis, of New Orleans, to provide funds for the conduct of medical research and the advancement of the medical sciences. The institute intends to establish various clinical and experimental divisions at medical schools and hospitals, the first of which has already been set up as the Center of Research of Hotel Dieu Hospital. All research carried on at these centers will be financed by the institute. Dr. Carlo J. Tripoli, assistant professor of medicine, Louisiana State University School of Medicine, New Orleans, has been appointed director of the institute.

FORDHAM UNIVERSITY will bring the celebration of its centennial year to a close on September 15, 16 and 17 with a program of lectures and round table discussions on topics of interest both to the general

public and to specialists. Distinguished American and Canadian scholars will offer the results of their cultural interests and pursuits in those fields to which the university has devoted its century of service: Classics, English, Romance Languages; History, Law, Sociology, Education, Economics; Philosophy, Psychology; Biology, Chemistry and Physics. On Tuesday evening there will be a dinner at the Waldorf Astoria. On Wednesday morning, following the academic procession, delegates appointed from colleges, universities and learned societies will be presented to the president, trustees and faculties of the university, and a number of honorary degrees will be conferred.

THE *Journal* of the American Medical Association reports that a grant of $52,000 from the Rockefeller Foundation for a cooperative program of research in biology and medicine to be conducted by the Mayo Foundation, Rochester, Minn., and the University of Minnesota has been received by the board of regents of the university. The gift will be used in the study of radioactive isotopes as tracers of fundamental biologic mechanisms. Under the direction of Dr. John T. Tate, members of the staff of the university and the Mayo Foundation have conducted this research since 1937, when a grant of $36,000 was awarded by the foundation. The university has also received from the foundation a grant of $17,000 to support research in the field of biophysics under the direction of Dr. Otto H. Schmitt, instructor in physics and biology.

ATLANTA UNIVERSITY, Georgia, will open this month a School of Library Science, made possible by a grant of $150,000 for endowment by the Carnegie Corporation of New York. To the income from this grant the university is adding money from other sources. The school will be of the class designated as Type II, that is, one requiring graduation from an accredited four-year college for admission, and offering a one-year professional course for the training of librarians. The annual enrolment will be limited approximately to twenty-five students whose academic records and personal qualities seem to indicate that they will succeed as professional librarians.

DISCUSSION

REORGANIZATION AT THE LOS ANGELES MUSEUM

SCIENTISTS throughout the world look to two agencies for the preservation and continuance of scientific phenomena, the great libraries and the great museums. The museum has come to be not only a place of exhibition but a repository of valuable scientific specimens, especially of types and co-types, requiring curators who are specialized in the abilities to classify and to organize such materials as may come under their stewardship. Among the several museums of America, one of the most important in many respects, because of its unique position in the Pacific Southwest, is the Los Angeles County Museum of History, Science and Art.

This museum was brought into existence on February 7, 1910, by a contract entered into between the Los Angeles County Board of Supervisors and four local organizations, namely, The Historical Society of Southern California, The Fine Arts League, The Southern Division of The Cooper Ornithological Club and The Southern California Academy of Sciences. According to this agreement these organizations were given the right to choose seven of the nine members of a board of governors, which was to administer the affairs of the museum. In January, 1918, this contract was amended to allow a gift of the Brea Beds, now Hancock Park, to be added under the supervision of the Los Angeles Museum.

A short time ago *Museum News* gave a very condensed account of certain changes that were to occur at the Los Angeles Museum. Because of its incompleteness, and because of the interest evidenced throughout the nation in this reorganization, it is regarded as timely to add a few remarks herein.

In 1938 the County Board of Supervisors, at the advice of counsel, declared the original contract invalid by appointing a new board of governors consisting of 15 members, none being chosen or suggested by the founding societies. Only one member on the present board remains as the chosen representative of a founding society. The same ordinance provided for the following directors: Finance and Operation, History and Anthropology, Science, Art, and Art Instruction. In 1939 a new ordinance established a director in charge and specified that the divisional directors should constitute themselves as an advisory council for the consideration of interdivisional matters and for other purposes concerning the best interests of the institution, reporting semi-monthly through the director in charge to the board of governors, its powers being recommendatory only.

In 1940 the ordinance establishing the administrative council was repealed, which made it possible to effect a complete and radical reorganization without consulting the directors of the several divisions. In April of this year the directors of history and science learned, through newspaper clippings, that such a change was scheduled to go into effect. The ordinance (as of May 22, 1941) which brings these changes provides for the abolition of the division of history, science and art and creates in lieu thereof the divisions

of exhibitions and education. The personnel of the former divisions are distributed to the two new divisions, with certain eliminations inevitable in the shake-up.

The staffs in history and science are drastically cut by a system of transfers. Demotions of the professional and technical personnel are made in all divisions, which includes directors, senior curators and curators, the latter reduced to curatorial assistants. Without cause, men and women of high scholastic standing and national reputation have been demoted. There have been no hearings, no impartial investigations.

It becomes apparent that a complete change is effected in the basic structure and functions of the museum which is at wide variance with the plan of the founders. In effect, it becomes a museum of exhibitions, art instruction and "education." The latter function serves principally as an instructing agency for the schools, and for circulating study materials. Both of these agencies have been carried on by the museum, under other names, since 1927, and supplements a similar activity of the Visual Education Section of the Los Angeles City School system. The directors of history and science have stated to the writer that in the past there has been no dearth of instructors to meet the needs of educational groups.

Following this action of the board of supervisors there developed such an avalanche of protesting letters and resolutions that the board of governors of the museum has appointed a special committee to investigate the matter. Chief among the protesting groups are the founding societies, who have a legal as well as scientific interest in the museum and who feel that the abrogation of their contract is ill advised and is working to the detriment of science in Southern California. Other protesting groups are the Southern California Academy of Sciences and the Federation of Natural Sciences of Southern California. To date some forty organizations have joined in this crusade against the crippling of science in the Los Angeles Museum.

It is gratifying to note with what high respect the research at the Los Angeles Museum is held by scientists throughout America, and it is hoped that the administrating and legislating boards in control thereof will keep the museum out of politics and treat with due regard those scientists who are striving to create in this cultural center a respect-worthy museum.

Committee of the Founder Societies of the Los Angeles County Museum of History, Science and Art
A. W. BELL, *Chairman*

BLOOD GROUP SPECIFIC SUBSTANCES AND BLOOD TRANSFUSIONS[1]

SINCE Landsteiner's classical investigations, the human race can be divided in four main groups according to their blood properties. The importance of the group-specific differentiation becomes apparent from the fact that not only the blood cells and spermatozoa but organs and tissue cells exhibit the group-specific characteristics. Such characteristics are also demonstrable in secreta and excreta. A complex carbohydrate-like substance with A-specific activity has been isolated by several investigators.

The specificity of this substance is shown by the "inhibition of agglutination" test as the combination of the A-specific substance, and the anti-A antibody present in normal human serum is usually not followed by visible precipitation. The subsequent addition of A blood cells to such a mixture constitutes the only way to prove that neutralization of the antibody has occurred; A cells are no longer agglutinated.

Blood of a homologous group is commonly used for transfusion purposes. Some thirty years ago, Ottenberg proposed that blood of group 0 could be used as universal blood because the blood cells of group 0 are not agglutinated by any normal human serum, except in very rare instances. Some large clinics use 0 blood in emergency cases and apparently are satisfied with their results. However, there are quite a few reports in the literature on severe reactions and even fatalities following the use of 0 blood in patients not belonging to group 0. These reactions are frequently attributed to the interaction of high-titered isoantibodies present in serum of group 0 and the cell properties of the patient. As a matter of fact, many institutions have abandoned the use of universal donor's blood.

In order to overcome the objection against the use of the universal donor as far as it is based on the presence of potent isoantibodies, we tried to add the isolated group-specific substances. At the beginning of our work only the A substance was available. The addition of the isolated A substance in amounts as small as 25 mg or less proved practically to be sufficient to neutralize the anti-A antibodies present in 500 cc of 0 blood.[2]

For the neutralization of the anti-B antibody present in 0 blood fluid, the B substance was needed. However, knowledge of the B-specific substance was very scant. Hallauer[3] had reported extracts of blood

[1] From the Buffalo General Hospital and the Department of Pathology and Bacteriology, University of Buffalo School of Medicine.

[2] E. Witebsky, N. Klendshoj and P. Swanson, *Jour. Infect. Diseases*, 67: 188–192, November-December, 1940.

[3] C. Hallauer, *Zeits. Immunitätsforsch.*, 83: 114, 1934.

xhibiting B activity. Very recently, Kin[4] has obained a carbohydrate-like substance from human aliva of group B. We isolated a carbohydrate-like ubstance from gastric juice of human beings of roup B, using a technique described by Goebel for he isolation of the A-specific substance from comercial peptone.[5]

Gastric juice was fractionated several times with volumes of alcohol in the presence of sodium acete yielding a crude polysaccharide. Traces of proein were removed by means of Sevag's procedure sing chloroform and butyl alcohol. After dialysis, protein-free carbohydrate fraction was recovered y precipitation with 10 volumes of acetone.

This B-specific carbohydrate-like substance is serogically as active as the A-specific substance. Its hemical analysis will be reported elsewhere. It may e sufficient to state in this connection that there seem o be interesting quantitative differences in nitrogen nd acetyl between the A and B substances.

Following the isolation of the B substance, the roblem arose whether individuals belonging to group possess an 0-specific substance comparable to the A- and B- specific substances, or whether the 0-group s characterized merely by the absence of A and B roperties. It is known that certain normal beef era, when treated with AB cells, agglutinate cells of roup 0 stronger than cells of other groups. A carohydrate-like substance was isolated from the gastric uice of human beings belonging to group 0 employng the same technique as for the isolation of the B-specific substance.[6] This substance inhibited the gglutination of 0 cells.

Whereas about 80 per cent. of human beings secrete arge amounts of group-specific substances in the aliva and gastric juice, 20 per cent. fail to do so. The carbohydrate fractions isolated from the gastric uice of the non-secretor group proved to be serologically inactive.

After the A- and B-specific substances were made vailable, the neutralization of both the anti-A and nti-B antibodies present in 0 blood was attempted. The addition of a mixture of a few milligrams of A- nd B-specific substances dissolved in 10 cc of saline olution proved to be sufficient for practical neutralization of the isoantibodies in 500 cc of 0 blood.[7]

Over 100 transfusions with "neutralized" 0 blood have been given in the Buffalo General Hospital mainly to patients belonging to groups A, B and AB without necessitating determination of the blood group of the patient and sometimes even without cross matching. From the clinical standpoint, the results are satisfactory, although we are fully aware that the problem as such can not be solved from a statistical angle. It is furthermore understood that the addition of the group-specific substances can not bring about any other change than the neutralization of the isoantibodies present in blood fluid of group 0. There are still many sources of transfusion reactions left that are obviously not influenced by the addition of the group-specific substances to 0 blood.

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CLINICAL ACHROMOTRICHIA[1]

DURING the past seven years I have been particularly interested in patients who needed endocrine therapy and who had gray hair. Soon after Lunde and Kringstad[2] and Morgan *et al.*[3] discovered that experimental achromotrichia may be due to a deficiency in a factor or group of factors belonging to the vitamin B complex, I began to administer relatively large doses of vitamin B complex products to gray-haired patients presenting metabolic problems and requiring thyroid treatment. Nine cases with endocrine dyscrasia received a vitamin B complex preparation[4] alone or together with endocrine substances. A marked change in the color of the hair was noted in all cases as a result of the above therapy. Definite darkening with many new natural colored hairs was striking evidence of the beneficial effects of the treatment. It is to be noted that the B complex preparation contained pantothenic acid.

In view of the fact that p-aminobenzoic acid has been reported to have chromotrichial activity for certain species[5] and is known to play a rôle in enzymatic pigmentation processes,[6] I investigated this substance clinically and wish to report the observations made during the past few months.

Fifty patients varying in age from 21 to 55 years with definite achromotrichia were picked at random. In 30 cases p-aminobenzoic acid was the sole therapy and in 20 cases endocrine products in conjunction with

[4] E. Kin, *The Journal of Chosen Medical Association*, 1940, 30: 4, 550–567, April 20, 1940.

[5] E. Witebsky and N. Klendshoj, *Jour. Exp. Med.*, 72: 6, 663–667, December 1, 1940.

[6] E. Witebsky and N. Klendshoj, *Jour. Exp. Med.*, 73: 5, 655–667, May 1, 1941.

[7] E. Witebsky, N. Klendshoj and P. Swanson, *Jour. Am. Med. Asn.*, 116: 2654–2656, June 14, 1941.

[1] Preliminary report.

[2] G. Lunde and H. Kringstad, Avh. Norske Vid.-Akad. Oslo, I. Mat. Ki., Nr. 1, 1938.

[3] A. F. Morgan, B. B. Cook and H. G. Davison, *Jour. Nutrition*, 15: 27, 1938.

[4] Bishop Laboratories' Elixir Be-vin Complex, dosage 5 ml twice daily, by mouth, or Solution B Complex 1 to 2 ml, subcutaneously.

[5] S. Ansbacher, SCIENCE, 93: 164, 1941; G. J. Martin and S. Ansbacher, *Jour. Biol. Chem.*, 138: 441, 1941.

[6] G. J. Martin, W. A. Wisansky and S. Ansbacher, *Proc. Soc. Exp. Biol. and Med.*, 47: 26, 1941; W. A. Wisansky, G. J. Martin and S. Ansbacher, *Jour. Am. Chem. Soc.*, 63: 1771, 1941.

the acid were administered. After about two months of treatment I observed in all cases a marked darkening of the hair. The recently grown shafts appeared to be normally pigmented. It is my impression that an oral dose of 100 mg twice a day is ample to give results. The data seem to show that p-aminobenzoic acid has the same effect with respect to graying as the B complex preparation used in my earlier studies.

In view of the favorable results obtained I am continuing my experiments with a considerably larger series of cases in order to establish the optimum daily dosage of para-aminobenzoic acid. The detailed data will appear elsewhere.

BENJAMIN F. SIEVE

TUFTS MEDICAL COLLEGE
AND BOSTON CITY HOSPITAL

QUOTATIONS

CHEMISTRY AND CANCER

ON our "Science in the News" page to-day is a collection of strange diagrams. They show the structures as the chemist conceives them of certain molecules known to produce cancer. It was for his brilliant fundamental study of these structures that Professor Louis Frederick Fieser of Harvard's chemistry department merited the Katherine Berkan Judd $1,000 prize of The Memorial Hospital for the Treatment of Cancer and Allied Diseases.

No one can now predict whether this particular study will be the one that will lead to that goal of so many wearying researches—the prevention of malignant cell growth and its non-surgical treatment. But there can be little doubt that if the goal is to be reached it must be through a more complete understanding of the body's own normal and abnormal chemical processes.

Memorial Hospital, in its hearteningly handsome building on East Sixty-eighth Street, provides the occupants of its 250 beds with the most modern x-ray machines, ranging in size up to 1,000,000 volts, with the most up-to-date devices for applying the curative radiation of radon gas, with the most skillful and aseptic surgery. But all these are drastic methods of dealing with a malignant growth that has already become dangerous. What about the cause? It is fortunate that beneath the same roof, under the direction of Dr. Cornelius P. Rhoads, men are working on the chemical root of the problem—subjecting experimental mice, for example, to the carcinogenic chemicals synthesized in Harvard's Converse Laboratory.

This correlation of the clinical and the chemical is one of the most encouraging aspects of modern cancer research. While doing all possible by present means for those already afflicted, scientists no longer base all their hopes on mysterious therapies whose modes of action are unknown. They are trying, step by difficult step, to reconstruct the chemical processes of life and ascertain the point at which those processes occasionally go off into the wilderness detour that we know as cancer. A substantial contribution toward that pathfinding is acknowledged in the award to Dr. Fieser, who thinks of the disease in terms of strange diagrams of molecular structure.—*The New York Times.*

SCIENTIFIC BOOKS

ORGANIC CHEMISTRY

High Polymers. Editorial Board, R. E. BURK, H. MARK and G. S. WHITBY. *Volume I. Collected Papers of W. H. Carothers on High Polymeric Substances.* By H. MARK and G. S. WHITBY. Illustrated. xix + 459 pp. New York: Interscience Publishers, Inc. 1940. $8.50.

Volume II. Physical Chemistry of High Polymeric Systems. By H. MARK. Illustrated. vii + 345 pp. New York: Interscience Publishers, Inc. 1940. $6.50.

IN the introduction to the series, "High Polymers," included in Volume I, the Editorial Board points out the technical and theoretical importance of high polymeric materials to the chemist. They set as their aim in this series the collection of our present knowledge in this field.

Volume I in the series, as the name shows, is a collection of the original papers of Carothers on high polymers and closely related topics. The volume contains a biography of Carothers; his papers reprinted under the headings: Studies on Polymerization and Ring Formation; Acetylene Polymers and Their Derivatives; Miscellaneous Papers; and a complete bibliography of Carothers' papers and patents. The value of the original papers has been increased by the preparation of an index which is a great aid to the student in locating specific topics.

Volume II in the series is essentially a revised edition of Professor Mark's "Allgemeine Grundlagen der hochpolymere Chemie." It contains a discussion of the fundamental concepts in general and physical chemistry which the author deems to be essential for the student who expects to work in the high polymer

field. Only a small portion of the book is devoted to the applications of these concepts to polymers, as the main object of the book is to provide an adequate background in physical chemistry for a proper appreciation of polymer problems.

C. S. MARVEL

UNIVERSITY OF ILLINOIS

Catalysis—Inorganic and Organic. By SOPHIA BERKMAN, JACQUE C. MORRELL and GUSTAV EGLOFF. xi+1130 pp. Illustrated. New York: Reinhold Publishing Corporation. 1940. $18.00.

THE importance of catalysts in chemical processes is phenomenal. The selection of catalysts and their preparation is still essentially an art; for this reason, the literature is extremely voluminous. This book comprises a stupendous compilation of material on heterogeneous and homogeneous catalysis, on various types of catalysts and their classification, conditions effecting activity, inhibitors, promoters, poisons and carriers. The arrangement is such that the reader readily may find either the facts about any catalyst or what catalysts may be used in any particular reaction. An enormous number of original references is given. The publication will be a welcome asset to the research chemist who desires an up-to-date handbook and reference work on catalysis.

ROGER ADAMS

UNIVERSITY OF ILLINOIS

The Ring Index—A List of Ring Systems Used in Organic Chemistry. By AUSTIN M. PATTERSON and LEONARD T. CAPELL. 661 pp. New York: Reinhold Publishing Corporation. 1940. $8.00.

THIS book represents a collection of known parent ring systems, arranged in order from the simplest to the most complex. Widely accepted names, other preferred names and systematic names are given. An original reference to each ring is cited. Rules for numbering are discussed. The publication has involved a tremendous amount of time and thought. It will be most helpful to the organic chemical investigator who so frequently must struggle with the appropriate naming of compounds under study.

ROGER ADAMS

UNIVERSITY OF ILLINOIS

The Theory of Organic Chemistry—An Advanced Course. By GERALD E. K. BRANCH and MELVIN CALVIN. Illustrated. xix+523 pp. New York: Prentice-Hall, Inc. 1941.

THIS book discusses the application of electronic structural theory to organic chemistry, with particular emphasis on the "resonance theory." The theories of the structure of atoms and molecules are outlined, stressing the quantum mechanical development. The authors then consider the application of these theories to various physical properties and to the energy relations and rates of certain reactions of organic compounds. Some of the principal topics included are the dimensions of molecules, dipole moments, spectra, the strength of acids and bases, tautomerism, oxidation-reduction potentials, free radicals and the rates of such reactions as substitution at a saturated carbon atom and addition to unsaturated compounds.

The authors state in the preface that they have avoided "a collection and evaluation of the mass of existing theories" and that, "This policy necessitates giving our opinions undue prominence. Ideas have been ignored on the slight grounds that we do not agree with them." In view of this policy it is not surprising that the treatment appears dogmatic and that the correlation of experimental and theoretical material is often highly speculative. However, such an interpretation of the variety of ideas which have come to be known as the "resonance theory" should be a useful contribution, whether or not the reader agrees with the ideas.

The book is well set up, printed and bound and has a minimum of typographical errors.

C. C. PRICE

Laboratory Outlines and Notebook for Organic Chemistry. By CECIL E. BOORD, WALLACE R. BRODE and ROY G. BOSSERT, all of the Department of Chemistry of the Ohio State University. Illustrated. ix+241 pp. 28 figs. New York: John Wiley and Sons, Inc. 1940. $1.75.

THE authors have provided an excellent combination laboratory manual and record book suitable for use in either a year's course in organic chemistry, or by proper choice of experiments, a one semester's course. The manual represents a gradual development over a period of twenty years and shows care and forethought. Each experiment contains a preliminary discussion, experimental procedure and space for observations. Questions and problems with blanks for answers follow each experiment. The discussion is succinct, the directions clear and concise. The student is taught to think about organic molecules in three dimensions by actually constructing molecular models in the laboratory. The work is up-to-date, including among its 69 experiments sulfanilamide, organic plastics and an introduction to qualitative organic analysis. Helpful information concerning reagents, supplies and list of necessary apparatus is given. The packaging of the required amounts of chemicals for each student for each experiment is recommended as a means of avoiding waste, preventing congestion at

balances and reagent shelves and materially speeding up the laboratory work. The book is well printed and bound in attractively colored cardboard covers with a spiral binding so that the pages lie flat, even though the book is folded back cover to cover.

R. L. SHRINER

SPECIAL ARTICLES

A STUDY OF HORMONAL FACTORS WHICH INFLUENCE THE PRODUCTION OF INSULIN[1]

THE present work had its origin in the attempt to devise a method for diagnosing diabetic "tendencies" prior to the time when positive diagnosis is obtained with the routine tests, as gathered from analyses of blood, urine and glucose tolerance curves. It seemed possible that stimulating carbohydrate metabolism in "normal" subjects and in those with diabetic "tendencies" might reveal differences in hormonal relationship which could, perhaps, be detected by urine analysis.

Some preliminary work was necessary before embarking upon the more ambitious part of our program; and the present report deals with several interesting observations.

In a study of carbohydrate metabolism, involving the activity of hormones, we had to consider, aside from insulin, the diabetogenic hormone (D.H.) and the insulinotropic substance (I. S.).[2]

Methods of extraction and methods of estimation are given by Best, Haist and Ridout and by Campbell and Keenan.[3] Methods of estimation are based upon the following facts: the injection of an extract containing D. H. will decrease the amount of insulin in the pancreas, whereas the injection of an extract containing I. S. will increase the insulin content.

For the assay of the diabetogenic and insulinotropic effects, the rat method of Best[3] was used, ten male albino rats of 200–300 g in weight being injected intraperitoneally for a period of 14 days. The insulin assay in the pancreas of rats was carried out according to the directions of Marks,[4] using 40 mice.

Based on the work of Campbell and Keenan,[3] a fractionation procedure for the anterior pituitary was developed. These authors describe the preparation of an active extract of D. H. We were hopeful that the anterior pituitary would also yield an active extract of I. S.; and we therefore prepared fractions from the residue obtained after complete extraction of D. H. by a 10 per cent. salt solution. Four fractions prepared and tested were the following: 1. An alkaline extract of the glandular tissue which had previously been extracted with a solution of NaCl (fraction 2); 2. A globulin-like material, soluble in salt solution and insoluble after dialysis; 3. A fraction recovered from the solution remaining in the dialyzing bag after dialysis; 4. The combined dialysates after elimination of NaCl. In each case the fractions were concentrated *in vacuo* and precipitated with alcohol-ether.

Using 10 rats per fraction, amounts were injected equivalent to 10 g of the original anterior pituitary gland. From the table it can be seen that fraction 3 exhibits a slight diabetogenic effect, and that fraction 1 shows insulinotropic activity. The other two fractions were found to be inactive.[5]

Another phase of the subject was suggested by the work of Marks and Young,[6] who reported that crude prolactin preparations exhibited marked insulinotropic effects, although they were of the opinion that the activity was not due to prolactin itself. Using highly purified samples of prolactin, we found, on the contrary, that they show definite diabetogenic activity (see Table 1).

The same authors pointed out that estrone, unlike testosterone, produces a definite insulinotropic effect.[7] We were able to confirm, to a certain extent, and to enlarge this observation (see table). The synthetic estrogen, stilbestrol, shows even more insulinotropic activity than estradiol; and progesterone, and more particularly, testosterone, show diabetogenic effects.

A fact worthy of comment is that an insulinotropic effect has been obtained using such widely divergent substances as a protein fraction of the anterior pituitary on the one hand, and estradiol and stilbestrol on the other. The activity of the latter substances may perhaps be explained by stimulation of the anterior pituitary.

[1] We are indebted to the following: Dr. Erwin Schwenk, Schering Corporation, for estradiol, progesterone and testosterone; the U. S. Vitamin Corporation, N. Y., for stilbestrol; Professor H. M. Evans, Professor Abraham White and Dr. Oscar Riddle for samples of prolactin; and Dr. David Klein, Wilson Laboratories, for supplies of pituitary glands. We wish to thank Dr. Julius Rosenthal, director of the Pathological Laboratories of the Welfare Hospital, for his interest in our work.

[2] The "diabetogenic hormone" tends to increase the amount of sugar in the blood and tends to decrease the production of insulin in the pancreas. The "insulinotropic substance"—there is some debate as to whether we are dealing with a hormone—stimulates the production of insulin.

[3] C. H. Best, R. E. Haist and J. H. Ridout, *Jour. Physiol.*, 97: 107, 1939; J. Campbell and H. Keenan, *Canadian Chemical Process Industry*, 23, 280, 1939.

[4] H. P. Marks, cited in "Biological Standardization" by J. H. Burn, pp. 91, etc.

[5] According to Campbell and Keenan, fraction 2 should have contained D.H.

[6] H. P. Marks and F. G. Young, *Lancet* II, p. 710, 1940.

[7] See, also, E. Cantilo, *Endocrinology*, 28: 20, 1941, who describes the beneficial effects of estrogens in menopausal diabetes.

TABLE 1

Substance	Amount injected	No. of rats	Total weight of rats (in g.)	Insulin Un. per 100 g. body weight	Per cent. change
Anterior pituitary fractions:					
Control	...	10	2,900	0.36	...
Fraction 1	518 mg	10	2,200	0.64	+77
Fraction 2	180 mg	10	2,100	0.38	0
Fraction 3	1129 mg	10	2,050	0.26	−28
Fraction 4	63 mg	10	2,350	0.34	0
Prolactin preparations:					
Control	...	10	2,340	0.42	...
Evans (sheep) .	400 I.U.	10	2,740	0.00	−100
Evans (sheep) .	490 I.U.	7	1,550	0.02	− 96
White (ox) ...	300 I.U.	10	2,550	0.08	− 81
Riddle (ox) ...	300 I.U.	10	2,530	0.22	− 48
Sterols and stilbestrol:					
Control	...	10	2,080	0.43	...
Estradiol	12.6 mg	9	2,160	0.54	+19
Estradiol	14.0 mg	10	2,060	0.51	+19
Stilbestrol* ...	11.2 mg	8	1,710	0.67	+56
Stilbestrol* ...	14.0 mg	10	1,800	0.62	+44
Progesterone ..	12.6 mg	9	2,730	0.39	− 7
Progesterone ..	14.0 mg	10	2,690	0.36	−16
Testosterone ..	14.0 mg	10	2,350	0.29	−31
Testosterone ..	14.0 mg	10	2,870	0.27	−37

* The weight loss is due to toxicity.

SUMMARY

1. Insulinotropic effects were obtained with a protein fraction of the anterior pituitary, with estradiol and with stilbestrol.

2. Varying diabetogenic effects were obtained with highly purified prolactin preparations, with progesterone, with testosterone and with a fraction, probably also protein, from the anterior pituitary.

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CURE OF EGG-WHITE INJURY IN RATS BY THE "TOXIC" FRACTION (AVIDIN[1]) OF EGG WHITE GIVEN PARENTERALLY

RECENTLY[1] it has been shown, in experiments dealing with dietary egg-white injury, that raw or commercial egg white can be supplanted by a particular fraction of egg white (avidin). Previously[2] the specific biotin-binding capacity of this substance had been established by the yeast-growth method,[3] according to which biotin, in the presence of avidin, becomes unavailable for yeast cells and growth therefore ceases.

It has been found[1] that instead of the 20 to 30 per cent. of raw or commercial egg white needed in the experimental rations to produce egg-white injury in rats, from 0.03 to 0.07 per cent. of avidin is equally effective.

In view of these experimental results the presence of egg-white injury has been explained by the fixation of biotin to avidin in the intestine, the probable non-absorption of the avidin-biotin (AB) complex and its consequent excretion with the feces.

This assumption is borne out by experiments in which the presence of the avidin-biotin (AB) complex in the feces was directly tested. In the absence of avidin, biotin is present in tissues and in feces in free and in bound form, the latter being liberated only by intensive hydrolysis.[3] The avidin-biotin complex, on the other hand, is easily split by steaming for a short time (30 to 60 minutes) at 100 C. By the yeast-growth method no difference could be found in the biotin content of feces before and after steaming (4 to 5 micrograms per gram) when rats were fed a normal stock diet. By the same method it was found that rats fed a diet containing cooked egg white plus avidin, however, excreted only negligible amounts of free biotin (in one experiment 0.1 microgram per gram), whereas after the feces had been steamed large additional amounts of biotin became free (4.4 micrograms per gram in the experiment cited).[4]

In order to answer the question how avidin may act in parenteral administration a series of special experiments was required.

Concentrates of avidin were prepared[5] according to the procedure described by Eakin, Snell and Williams.[2] The biotin-binding capacity of each concentrate was tested quantitatively by the yeast-growth method.

To learn their effect on egg-white injury the avidin preparations were thoroughly mixed with pulverized, cooked dried egg white in varying amounts in different experiments which corresponded, on the basis of bio-

[1] The designation of the "toxic" protein of egg white tentatively proposed as *avidalbumin* (P. György, C. S. Rose, R. E. Eakin, E. E. Snell and R. J. Williams, SCIENCE, 93: 477, 1941) has been modified by the Texas group to *avidin*, because this protein does not entirely fit into the classification of an albumin. Additional details have now been published (R. E. Eakin, E. E. Snell and R. J. Williams, *Jour. Biol. Chem.*, 140: 535, 1941). In the present and previous studies avidin concentrates have been used, as pure crystallin avidin has not been available.

[2] R. E. Eakin, E. E. Snell and R. J. Williams, *Jour. Biol. Chem.*, 136: 801, 1940.

[3] E. E. Snell, R. E. Eakin and R. J. Williams, *Jour. Am. Chem. Soc.*, 62: 175, 1940.

[4] By variation of the normal diet and by feeding a pure meat ration we have so far been unable to detect in the feces of rats AB from which biotin could be liberated by steaming unless egg white was also present in the diet.

[5] The authors wish to express their thanks to Professor R. J. Williams and his collaborators, of the Department of Chemistry, University of Texas, for sending a generous supply of avidin concentrates. Other concentrates were prepared in the Laboratory of the Babies and Childrens Hospital of Cleveland.

tin-binding capacity, to the equivalent of from 0.6 to 2.4 gm of egg white per 10 gm of the diet. This mixture was substituted for the original commercial egg white in the experimental diet[6] used for the production of egg-white injury. Control experiments were carried out with rations containing (1) cooked egg white without the addition of avidin and (2) commercial egg white. Additional special groups of rats fed these two control rations were injected with avidin dissolved in normal saline solution; the daily amounts varied in terms of biotin-binding capacity from the equivalent of 0.3 to 1.2 gm of egg white.

Avidin mixed with the food proved to be "toxic" even in the small doses of one third to one fifth the amount used in previous experiments.[1]

Avidin given parenterally, however, did not seem to exert any toxic effect and was unable to prevent improvement in the manifestations of egg-white injury when cooked egg white was substituted for the original commercial egg white in the diet. Pathological symptoms seemed to disappear more rapidly and the gain in weight appeared more extensive in these animals than in the control rats which received the diet containing cooked egg white without the simultaneous injection of avidin. This impression was substantiated by experiments in which rats kept on the original egg-white injury producing diet[6] were treated, when they were severely "injured," with daily injections of avidin preparations dissolved in normal saline solution. It has been demonstrated that avidin concentrates which are "toxic" when they are given enterally may be of high therapeutic value when they are administered parenterally. The selected examples given in Table I illustrate this conclusion.

TABLE I

Group	Diet containing	Avidin administered	Weight response (gm)	Effect on egg-white injury
A	Cooked egg white	By mouth for 12 days:		
		Rat No. 6344	− 3	Intensified
		Rat No. 6441	− 7	Intensified
		Rat No. 6442	− 7	Intensified
B	Commercial egg white	Parenterally for 12 days:		
		Rat No. 5845	+37	Almost cured
		Rat No. 6097	+42	Almost cured
		Rat No. 6289	+23	Almost cured

An explanation of this paradox must take into consideration the presence of biotin in the avidin preparations. These concentrates contain a large excess of free avidin and, in addition, bound biotin (AB). In one of our preparations the analysis of the daily dose revealed the presence of free avidin in an amount which would inactivate 17 micrograms of biotin as well as the presence of 1.2 micrograms of biotin already bound (AB). It can be assumed that, whereas under the conditions prevailing in the intestine AB is a stable compound and biotin is thus inactivated, in the parenteral medium a split occurs which liberates the concealed biotin and as a result the biotin acts therapeutically.

The smallest content of biotin found thus far in an avidin preparation which brought about complete cure of egg-white injury in rats when it was administered parenterally was 0.1 microgram in a vehicle of 180 micrograms of avidin preparation. This amount is not far from the therapeutic rat unit (0.04 microgram).[7]

Further experiments are needed to throw light on the special factors which promote liberation of bound biotin from the avidin-biotin (AB) complex under parenteral conditions.

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BIOTIN AND THE GROWTH OF NEUROSPORA

FIVE races of *Neurospora* were found to be biotin-deficient organisms and to require for growth the presence of biotin in the medium. None grew more than slightly in a mineral-glucose solution containing asparagine,[1] or on the same medium solidified with agar which had been purified by extraction with 5 per cent. pyridine and ethyl alcohol.[2] The addition to these media of peptone, potato extract,[1] agar extract[2] or pure biotin methyl-ester[3] permitted normal growth. Thiamin was ineffective.

The following races were used: *N. sitophila 56.2* and *56.6; N. tetrasperma* S_1 and S_9; *N. tetrasperma* J_1, carrying the dominate lethal E; *N. tetrasperma* C_4 and C_8 carrying the recessive lethal *d*. A wild strain of *N. sitophila,* collected in Bermuda by Dr. F. J. Seaver, was also tested.

Twenty-five ml quantities of a basal mineral-glucose solution containing asparagine in 125 ml flasks were inoculated with small bits of mycelium. A thin mat of mycelium 3 or 4 mm in diameter formed in the liquid within seven days, but no further growth occurred. Sub-cultures into the same medium grew about as well but no better. The basal solution was varied by the addition of thiamin, potato extract, agar extract or pure biotin methyl-ester. The addi-

[6] P. György, *Jour. Biol. Chem.*, 131: 733, 1939.

[7] P. György, C. S. Rose, K. Hofmann, D. B. Melville and V. du Vigneaud, SCIENCE, 92: 609, 1940.

[1] Wm. J. Robbins and K. C. Hamner, *Bot. Gaz.*, 101: 912–927, 1940.

[2] Wm. J. Robbins and Roberta Ma, *Bull. Torrey Bot. Club*, in press.

[3] The biotin methyl-ester was furnished through the courtesy of Dr. Vincent du Vigneaud.

tion of thiamin had no effect on the growth of any of these strains. They all grew rapidly in the solutions with potato extract, agar extract or pure biotin. S_1 and S_9 grown together produced abundant conidia and perithecia in these solutions. Mature ascospores were observed in the solutions with potato extract and agar extract but not in those with the pure biotin. 56_2 and 56_6, non-conidial races, produced perithecia and mature ascospores in all these solutions. C_4 and C_8 together produced abundant conidia and perithecia, but no ascospores were formed, which is normal for a mating of these recessive lethal races. J_1 formed conidia and abundant perithecia. A small number of ascospores matured in cultures of this lethal. The Bermuda strain was unisexual and produced abundant conidia. Protoperithecia formed in the solutions with biotin and potato extract. The presence of biotin in potato extract[4] and agar extract[2] has been reported.

The effect of biotin on S_1 and C_8 was studied in agar cultures containing the basal solution solidified with 1 per cent. purified agar. Tubes were inoculated with one drop of a suspension of conidia in distilled water. Both strains grew very little on the purified agar but grew rapidly with the production of abundant conidia when pure biotin, agar extract or neopeptone was added. Higher concentrations of biotin, 0.05 microgram per culture, or agar extract equivalent to 5 per cent. agar, caused a larger number and more rapid development of the protoperithecia. Cultures of C_8 lost their typical lethal appearance and grew like normal *N. tetrasperma* when agar extract, equivalent to 1 per cent. agar, was added, but showed all the features characteristic of the lethal form when agar extract equivalent to 5 per cent. agar was added.

Although all the strains tested were biotin-deficient and grew little or not at all without the addition of that growth substance to the medium, a synthetic medium containing biotin as the sole growth substance was entirely satisfactory for the 56_2 and 56_6 races only. Additional factors of some type appear to be necessary for free production of ascospores by the combinations S_1 and S_9, C_4 and C_8 and the bisexual J_1 race. A detailed report of this work will be published.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A PRECISION FINE ADUSTMENT FOR STANDARD MICROSCOPES

EXPERIENCED microscopists have long maintained that correct interpretation of three-dimensional structures, particularly of biological materials, can only be obtained by continual refocusing. For illustration purposes drawing can suggest the third dimension, but this is not real evidence, since interpretation is involved.

Single photomicrographs involve interpretation since the third dimension is not indicated. However, series of photomicrographs taken with constant differences of focus can show all the changes in appearance that the microscopist sees. Though such series can not be made with the unmodified standard microscope, they can be made with the Graton[1] microscope and with the standard microscope fitted with a lever and a tangent screw. Illustrations made with such a microscope are shown in a paper now in press by Hamly and Watson.[2]

The instrument used in making the above-mentioned illustrations was designed some three years ago, and since then many series of photomicrographs have been made with it. The figure shows part of the Zeiss microscope model #1c (1906) and the modifications made. Most modern microscopes could be so changed; the microscope must have a rigid stand and a fine motion with low lag, smooth operation and low friction.

While the scale indicates 0.1μ divisions, springiness and lag can make small movements meaningless unless certain precautions are taken. They are: (a) the microscope must be moved upward rather than downward by the tangent screw; (b) the microscope should not even be touched during focusing; (c) preliminary visual adjustments should be made carefully until the operator is certain that the principal optical cross section is included in the series. Good series are made with differences of 0.2μ, but this is close to the practical limit caused by residual springiness and lag.

All photographs of the series should be made on the same plate or film, so that all peculiarities of emulsion, development and fixation will be common. Variable exposures can be eliminated by the use of an automatic shutter, or stop watch, provided the source of light does not vary. Series of exposures on one plate or film are easily made in a camera fitted for a sliding plate holder such as the Zeiss Multiplex which the author uses.

The precision motion is not much help in ordinary visual work except in making measurements. How-

[4] Wm. J. Robbins, *Bot. Gaz.*, 102: 520–535, 1941.
[1] L. C. Graton and E. B. Dane, *Jour. Opt. Soc. Amer.*, 27: 355–376, 1937.
[2] D. H. Hamly and J. H. L. Watson, *Trans. Roy. Soc. Canada.* In press, 1941.

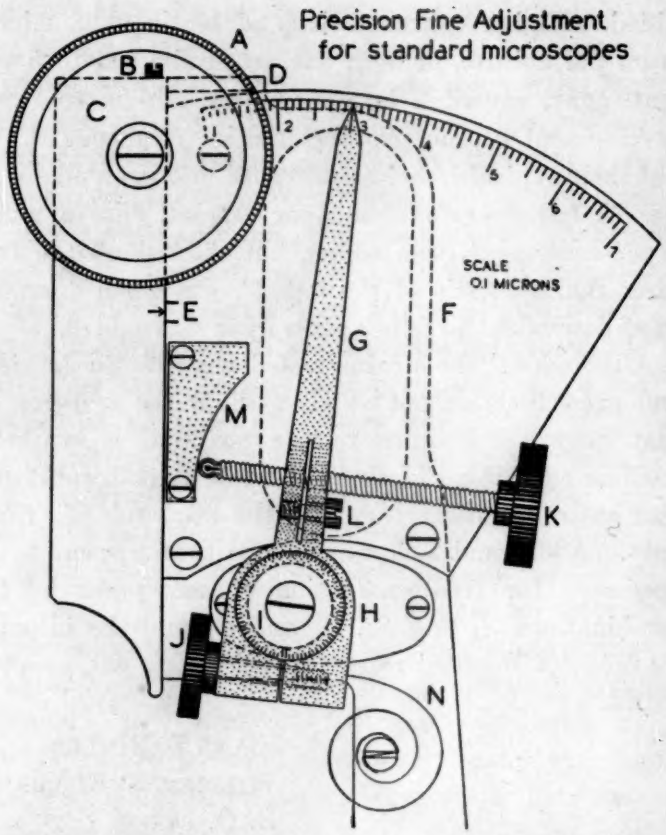

FIG. 1. A—Coarse adjustment; B—Friction regulating screw for coarse adjustment; C—Coarse motion slide bar; D—Cover plate for fine motion; E—Fine motion limit marks; F—Back of microscope limb; G—Lever and scale indicator; H—Thick split sleeve; I—Free end of fine motion knob; J—Locking screw; K—Precision fine motion adjustment screw; L—Friction controlling screw for K; M—Tangential thrust block; N—No lag spring. Scale engraved with 0.1μ divisions. Motion adapted to Zeiss Microscope Model 1^c (1906).

ever, the normal use of the fine motion[1] is not handicapped and whenever desired the precision motion can be engaged by locking with screw. The "feel" of the fine motion is not changed by the precision modification.

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CARRIAGE FOR A LARGE NUMBER OF SPECIMENS DURING PARAFFIN INFILTRATION

THE effort usually involved in the simultaneous handling of a considerable number of specimens during paraffin infiltration can be materially reduced by means of the following device. The dimensions given here (Fig. 1) are adapted to the usual staining vessels, but can of course be adjusted to individual requirements. The carriage is constructed of fine-meshed copper milk screen. The partition strips are notched and fitted together like the separators in an ordinary egg carton, and drops of solder applied to a few of the joints where necessary. A suitably bent piece of copper window screen placed in the paraffin

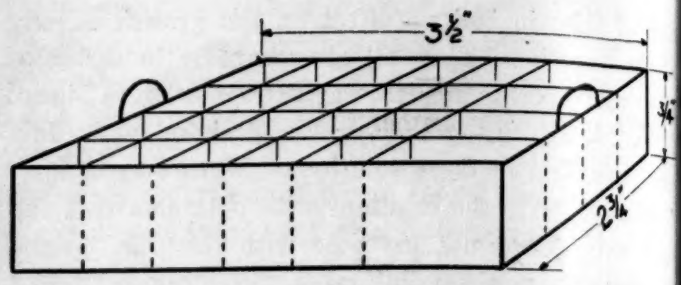

FIG. 1. Tissue carrier made of copper milk screen.

vessel is desirable in order to support the carriage a short distance from the bottom. The entire carriage is immersed in the paraffin bath and can be transferred through as many changes as the size of the tissues may require. The same series of paraffins can be used repeatedly.

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DRAINAGE IN THE LITTLE-WELLS APPARATUS FOR GAS ANALYSIS

LITTLE and Wells[1] have described an apparatus for student use in the analysis of samples of respiratory air. Two burettes of the type described have been tested in this laboratory. As noted by the authors, great care was taken to insure complete drainage, but because of the narrow bore of the stopcock excessive shaking was required which resulted in the breakage of one piece of apparatus. The addition of ½ per cent. isopropyl alcohol to the saline solution used for leveling, and modification of the technique so that the absorbent solutions were washed down each time with approximately one cc of saline solution have eliminated this difficulty. The accuracy of the technique in the hands of student operators remains unchanged.

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[1] J. Max Little and Herbert S. Wells, SCIENCE, 2340, 425, 1939.

BOOKS RECEIVED

CLARK, AUSTIN H. *A Monograph of the Existing Crinoids: Vol. I, The Comatulids.* Bulletin 82, U. S. National Museum. Pp. vii + 603. 61 plates. U. S. Government Printing Office, Washington, D. C. $1.50.

COCHRAN, DORIS M. *The Herpetology of Hispaniola.* Bulletin 177, U. S. National Museum. Pp. vii + 398. 120 figures. 12 plates. U. S. Government Printing Office, Washington, D. C. $0.70.

HOLMES, HARRY N. *Out of the Test Tube.* Third edition, revised. Pp. x + 305. 101 figures. Emerson Books, New York. $3.00.

LOEB, LEONARD R. *A Laboratory Manual of Electricity and Magnetism.* Revised edition. Stanford University Press. $1.90.

SHERBON, FLORENCE B. *The Child; His Origin, Development and Care.* Pp. xx + 755. 188 figures. McGraw-Hill. $3.50.

WAISMAN, HARRY A. and C. A. Elvehjem. *The Vitamin Content of Meat.* Pp. ii + 210. Burgess. $3.00.